THE EFFECT UPON GLANDULAR TISSUE OF EXPOSURE TO THE X-RAYS.[1]

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THE beneficial effects of the X-rays are so enthusiastically proclaimed by the advocates of its therapeutic use in granular swellings and certain of the new growths, that I think a few of its disadvantages should be spoken of by those who see the after effects and who are forced to operate upon tissues that have been long under its influence. My own personal experience is such as to lead me to advise against the employment of the X-rays wherever there is a probability of the case coming to a formal surgical operation. On account of the alteration in appearance and character of the tissues where its use has been prolonged, operations which would ordinarily be simple and easy dissections become formidable and dangerous, as the tissues are thickened and matted together by fibrous material.

This change in the character, both of the surface skin and underlying tissue, is particularly well marked in cases of enlarged cervical glands,—the so-called tubercular adenitis. Ordinarily operations for this condition are easy to perform, the glands readily peel out by blunt dissection, and the blood-vessels and nerves retain their distinct characteristics, thus being plainly recognized and preserved from injury. The physical characteristics of the tissues of the necks which have been subjected to treatment by the X-rays are, however, markedly changed in appearance; the glands become hardened, and may be shrunken if this method of treatment is employed before they have broken down, and while it is true

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that in cases of recent origin many of the swollen glands may entirely disappear, this is not usual. The majority of the glands which the surgeon sees have already broken down and softened in their interior, and the cheesy pus may be simply incapsulated. It is of this variety particularly that I wish to speak.

Most of these cases are of long standing and have been subjected to various plans of treatment by ointment, massage, counter-irritants, etc., before the X-rays are employed. It is only after all the various methods have been tried that the surgeon is requested to operate.

The overlying skin is now found to be thickened, indurated, and much toughened. The glands cannot be peeled out, or pulled away from the blood-vessels and nerves by blunt dissection, but each step must be taken with the greatest deliberation and every particle of tissue that is removed must be separated by cutting with the knife or scissors. The blood-vessels, from the fibrous thickening of their sheath and the surrounding tissues, cannot be easily distinguished; and are only saved from being cut by the utmost vigilance. The dangers, the difficulties, and the time consumed in the operation are thus very materially increased, and my own belief is that the only action of the X-rays in these cases is distinctly harmful.

I have had one case of cystic disease of the left breast in an unmarried woman of 37 where the X-rays were employed, and which subsequently came to operation. The history was that a year before she had discovered a lump in her left breast, but it gave her no discomfort. She consulted a physician, who advised operation, but as her father was very ill and she was nursing him, she refused operative treatment at that time, as she would not leave him. Her family history was bad, as her mother had had cancer of the uterus and her father's illness was supposed to be cancer of the stomach. She elected to try the value of the X-rays and submitted to twenty-eight treatments of ten minutes each. As a result there was an extensive burn of the skin of the

whole breast; the outer layer of the skin peeled off, and this was true also of the areola and nipple. I saw her first when this burn was at its worst. I could feel that the breast was enlarged and that in the gland there was a swelling, which I took to be, and still believe to have been, a cyst. Shortly after this her father died and she then came to me and submitted herself to operation.

The skin over the whole of the breast was very dense and hard and in a condition such as I had never seen before. It was almost impossible to cut through the skin with a very sharp knife without using extreme force. The breast and both pectoral muscles were removed and the axilla cleaned out. At this time I could not distinguish definitely a tumor, but the whole breast was thickened and indurated. The breast, after its removal, was cut open and macroscopically seemed to be simply a mass of fibrous tissue with few of the characteristics of the normal gland. There were one or two small rentention cysts. She made an absolutely uneventful recovery, but the wound did not heal quite as rapidly as is usual. The breast was sent to Dr. Longcope, of the Ayer Laboratory, who made this report:

The specimen consists of a breast, pectoral muscle and axillary fat. Section has been made through the breast. It is covered by a piece of skin 1 cm. in diameter. The center appears yellowish and slightly ulcerated. On section the cut surface discloses opaque white breast tissue, which is slightly larger than normal. It is fairly well circumscribed and has a more or less pyramidal form. The margins are well defined, particularly the lower margin, which is separated from the pectoral muscle by a zone of fat about 1 cm. in thickness. The breast tissue is quite firm but flabby. Scattered through it can be seen bits of fat. Here pectoral muscle appears normal. The axillary lymph glands are small, soft and pink in color.

Sections are made from all parts of the breast. They show a coarse net-work of rather dense fibrilated connective tissue enclosing lobules of fat-cells of various sizes. The connective tissue contains extremely few cells. In many sections the acini are lined by two regular rows of cuboidal epithelium which do not differ essentially from the normal, except that many of the

cells contain large fat droplets. Sections through four of the axillary lymph nodes show chronic inflammatory changes. There is some hyperplasia of the lymphadenoid tissue with thickening of the reticulum, especially in the lymph sinuses and proliferation of the recticular cells.

The lymph sinuses are converted into solid cords. The capsule is regular but a little thickened.

Skin.—The epidermis is thickened. At one point there is a small area of ulceration. Here the corium is covered with a thin layer of fibrin. Polymorphonuclear leucocytes and red blood-cells. The corium is greatly thickened and the papillary process atrophied. It consists of rather dense connective tissue infiltrated in circumscribed foci by cells usually of one type. These cells are scattered through the corium, but are most numerous beneath and about the ulcerated surface. They are somewhat smaller, irregular, often have a shriveled appearance and the protoplasm stains intensely blue in hæmotoxylin and eosin stains. The nuclei are very black and piknotic. Sometimes they show a central unstained band which gives the nucleus the appearance of a diplococcus. About the ulcerated area there are also many small round cells, a few polymorphonuclear leucocytes and occasional large multinucleated giant-cells.

Diagnosis.—Chronic mastitis with atrophy of mammary gland. Chronic inflammation of skin with thickening of corium. Chronic inflammation of axillary lymphnodes.

Dr. Longcope states in a letter which accompanies this report that there was no evidence of malignant growth, but, on the contrary, there was marked atrophy of the glandular tissue with extensive fibrous overgrowth in a diffused manner. He considers the thickening of the skin must have been caused by the X-rays, but whether the changes in the breast itself are due to this cause he cannot state positively.

In a very carefully written article by Dr. A. G. Ellis, "The Pathology of the Tissue Changes Induced by the X-Ray" (*American Journal of Medical Sciences,* January, 1903), he quotes Huntington as stating that the X-ray burn consists of an acute, subacute, or chronic necrobiosis. He

quotes Rudis-Jicinsky as saying that, "The irritation of the peripheral extremities of the sensory nerves causes paralysis of the vasomotor and vascular cells affected. Spasmodic contraction of the arterioles and capillaries follows and the proper nutrition of the cells is impaired. With these changes, which are directly depending upon disturbances of the circulation, there are changes in the parenchyma cells of the affected region. The death of tissue follows, being caused by permanent stasis in the blood-vessels. This is carried out by Codman's statement (Ellis) that the reports of microscopic examinations of the excised tissue agree in stating that similar arterial branches are occluded and the appearances are not unlike those of necrosis and inflammation due to other causes.

Scholtz (Ellis) says that the cell elements under the influence of the X-rays undergo a slow degeneration, chiefly in the epithelial cells; that the nucleus as well as the protoplasm of the cell is affected. This article by Dr. Ellis is so exhaustive and carefully prepared that it should be read by all who are interested in this subject.

In the X-rays we have a very powerful therapeutic agent, whose power for good is undoubtedly very great in inoperable malignant disease of a superficial character and as a prevention of the recurrence of malignant disease after radical operation; but I believe that its use should be confined to this class of cases. I do not believe, in view of the extreme difficulties and complications which are produced by its effects, that it should ever be employed upon the tissues before surgical operation is undertaken.